LINEAR ALGEBRA AND ITS APPLICATIONS

CALL FOR PAPERS

Special Issue on *Order Reduction of Large-Scale Systems*

Order reduction is a common theme within the simulation of complex physical processes. Such simulations often result in very large systems. For example, large systems arise due to accuracy requirements on the spatial discretization of fluids or structures, in the context of lumped-circuit approximations of distributed circuit elements, such as the interconnect or package of VLSI chips, or in simulations of micro-electro-mechanical systems (MEMS), which have both electrical and mechanical components. Dimension reduction is generally required for purposes of expediency and/or storage reduction. Applications include compressed representation, efficient data analysis and feature extraction, real-time analysis, construction of low-order control mechanisms, and many others. Various reduction techniques have been devised, but many of these are described in terms that are discipline-oriented or even application-specific even though they share many common features and origins. This special issue is devoted to exposing the similarities of these approaches, identifying common features, addressing application-specific challenges, and investigating how recent reduction methods for linear systems might be applied to nonlinear problems.

LAA has previously published four special issues devoted to the field of Linear Systems and Control: 1983 (vol. 50), 1989 (vols. 122–124), 1994 (vols. 203–204) and 2002 (to appear). The cross fertilization between numerical linear algebra and linear system theory has been very fruitful. Now, we feel it is time to broaden the scope of these interactions. In the past decade there has been considerable activity in the area of dimension reduction for linear dynamical control systems. However, dimension reduction has a much broader range of application and interpretation. The goals of this special issue are to highlight leading approaches and remaining problems in model reduction for linear system theory, emphasize connections to POD, extend theory and methodology to nonlinear problems, address application-specific techniques.

This special issue will be open to all papers with significant new results in dimension reduction of large systems where either linear algebraic methods play an important role or new tools and problems of linear algebraic nature are presented. Survey papers that illustrate common themes across disciplines and application areas, and especially where Linear Algebra techniques play a central role are highly encouraged. Papers must meet the publication standards of LAA and will be refereed in the usual way.

Areas and topics of interest for this special issue include, but are not limited to:

- Methods and Theory for
  - Linear dynamical systems (time-invariant and time-varying systems)
  - Descriptor (singular) systems
  - Nonlinear dynamical systems
  - Second-order systems
  - Passive systems
  - Infinite-dimensional systems (e.g., PDE based systems)
- Low-Order Modeling
  - Proper orthogonal decomposition (POD)
  - Wavelet techniques in dimension reduction
  - Reduced models of distributed circuit elements
- Application-Specific Techniques for
  - Conservative systems (e.g. Molecular Dynamics)
  - Computational fluid dynamics
  - Structural analysis (e.g., condensation or sub-structuring)
  - Micro-electro-mechanical systems (MEMS)
  - Image processing
  - Chemical kinetics
- Low-Order Design
  - Low-order filter design techniques
  - Controller reduction techniques

The **deadline for submission** of papers is **March 31, 2003**, and the special issue is expected to be published in 2004. Papers should be sent to any of its special editors:

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